Identification and Classification of Diseases: Fundamental Problems in Medical Ontology and Epistemology

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During the last three centuries there has been remarkable development in the area of the identification and classification of diseases. The taxonomic systems adopted in the 18th century by, for instance, Sauvages and Linnaeus bare no resemblance to the modern nomenclatures for pathological phenomena. The aim of this paper is to give a brief historical presentation, but also a critical analysis, of a number of crucial ideas and theories behind the construction of certain major disease classifications. My focus in the second half of the paper is on the most influential modern systems of classification, the *International Statistical Classification of Diseases and Related Health Problems (ICD)* and the *International Systematized Nomenclature of Human and Veterinary Medicine (SNOMED)*. The former is the official classification adopted by the World Health Organization and is used mainly for clinical and administrative purposes. The latter is a highly complex system of classification which has recently been developed for a variety of purposes (including medical research) and is meant to be read and handled by computers. ICD, although widely used all over the world, has salient and well-known logical deficiencies. SNOMED has been introduced partly to remedy these deficiencies. I conclude, however, that SNOMED, in spite of its sophisticated resources, cannot completely replace ICD. For many clinical and administrative purposes there is need of a relatively simple system that can be handled by the ordinary doctor and the ordinary health-care administrator.

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1. Introduction

It is difficult to identify and classify diseases. They are not like plants or animals, which have since the time of Aristotle been the paradigm entities for

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traditional scientific classification. Whereas plants and animals are physical objects that one can apprehend with one's sensory organs, this is not the case when it comes to diseases. These are diffuse and often hidden. They come and go, and they do so in often unpredictable ways. The ontological status of diseases has always been, and still is, unclear. Are they really "objects" at all? Or are they rather processes or dysfunctions? And, in the latter case, how should they be characterized and collected into well-defined categories?

In the history of medical ideas the term 'physiologism' stands for a particular attitude towards the task of medical classification. The physiologists have difficulty in ordering disease phenomena into clear categories. They are bewildered by the enormous individual differences between particular cases of the same disease, bewildered by the fact that no one case is exactly like another. Diseases, they say, are not new entities but just variations in the normal functioning of the body. As a consequence, these theorists consider that categorical labels distort rather than illuminate the reality of disease. In contrast, the ontological camp, which includes a great variety of thinkers, opposes the physiologists in asserting that diseases are entities in their own right: to speak of a disease is to speak of a *thing*, not just of an imbalance or disturbance in ordinary physiological functioning.

During the 17th and 18th centuries, the idea of diseases as some kind of objects, albeit rather special objects, was prevalent. The English physician Thomas Sydenham, who was perhaps the first theoretician in modern times to reflect upon these matters in a systematic way, was firmly convinced of the possibility of drawing a complete picture of each disease. In the first place, he said, all diseases should be reduced to certain definite species with the same care as we see exhibited by botanists in their description of plants. In the second place, all hypotheses and philosophical systems should be entirely set aside and the pathological phenomena should be described with the same accuracy as exhibited by a painter in painting a portrait.

In the third place, in making this description, the particular and constant symptoms should be clearly distinguished from the accidental phenomena, which may vary with the age and constitution of the patient. Disease was to Sydenham a clinical rather than an anatomical-physiological deviation and could be defined as a group of individual symptoms with their common characteristics and their development over time. Diseases could be reduced to particular species as in botany, where a distinction is made between *genera* and *species*. A disease should be characterized by its general characteristics and its specific characteristics. Sydenham was highly critical of the chemical speculative theories of the nature of diseases. In his day, there was a wide chasm between the scientific anatomical inquiries and chemical theories of the learned physicians and the doctor's practice at the bedside.

The first comprehensive taxonomic system based on Sydenham's ideas was produced by the French researcher Fran?ois Boissier de la Croix de Sauvages (1706–67). He was himself a botanist besides being a physician, and in his books he sought to group diseases in classes, orders and genera. Such an attempt was at the time quite original. In his *Nosologia methodica* (1763), he distinguishes 10 classes, 44 orders, 315 genera and 2,400 species.

A modern medical taxonomist would be highly critical of all this. Such nosologies, however ingenious they were, grouped together symptoms that have a superficial resemblance but differ widely in pathogenesis and significance. The systems give us very little understanding of the true nature of disease. In order to make real advances we must, the modern taxonomist would say, gaze under the skin of the human body.[1]

2. Towards modern systems of classification

Modern textbooks of medicine describe diseases not just as clusters of symptoms but in all their (known) complexity and variability. The development from the symptom theories of the 18th century to today's conceptions occurred in several steps. The first significant change came by way of the rapid growth of pathology in France and Germany. Xavier Bichat and Rudolf Virchow were two of the most outstanding figures in this development. Through new insights concerning pathological changes in body tissues, accompanied by the hypothesis that these changes are responsible for symptoms, the fundamental site of disease was moved to the inner parts of the body. The essence of disease was now seen as being organic change, and symptoms were seen as being more superficial phenomena. The rise of cell biology and that of bacteriology were further significant milestones in our perception of the nature of disease. After these scientific revolutions, diseases were primarily regarded as microscopic processes—as cell reactions to microbe invasions. Today, we are observing another major revolution, namely the genetic one, which informs us that the fundamental site of many diseases lies in the DNA structure of the bodily cells.

Such fundamental changes in our perception of diseases must of course have repercussions for our classification of them. What are the things that we are classifying? And can we in any reasonable sense say that the systematician from the 18th century and the one from the 19th century are classifying one and the same type of thing? If Sauvages classifies fevers—without taking account of the pathogenesis of these fevers—and a French patho-anatomist classifies tissue changes, some of which cause fevers, are they then classifying

[1] For a summary of the ancient systems of classification, see (Faber 1923), (King 1982) and (Fagot-Largeault 1989).

the same diseases? What does "the same" mean in such a case?

We see here in a nutshell an almost insurmountable problem for medical classification. An important medical revolution—be it patho-anatomical, cell-biological, bacteriological, molecular-biological or genetic—may transform our way of identifying diseases, and this has immediate consequences for nosology and classification.

A comparison with regard to the sickness panorama from one age to another is therefore very difficult. The possibilities of error are numerous, not least because a conceptual change is not always complemented by a terminological one. Let me illustrate this by looking into the history of "one" particular disease, *diabetes mellitus*.

The term 'diabetes' is extremely old. Moreover, knowledge of the diabetical syndrome is almost equally old. As long ago as 200 BC, the Greek doctor Aretaeus of Cappadocia gave a colourful picture of the diabetic syndrome.

> Diabetes is a wonderful affection, not very frequent among men, being a melting down of the flesh and limbs into urine …the patients never stop making water, but the flow is incessant, as if the opening of aqueducts …life is disgusting and painful; thirst unquenchable; excessive drinking, which however is disproportionate to the large quantity of urine, for more urine is passed; and one cannot stop them either from drinking nor making water. (Aretaeus 1972, 228)

The ancient diabetes syndrome would appear to consist of the following elements: extreme thirst; extreme urination; tendency to desiccation; feelings of nausea; and restlessness. Diabetes remained essentially a clinical syndrome until the middle of the 19th century. Then one can observe an evident organic anchoring of the disease. Let me summarize this history in the following points:

> Claude Bernard, ca 1850: Diabetes is a disturbance of the normal metabolism, in the sense that an excess of sugar is excreted into the urine.
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> Oskar Minkowski, ca 1890: Diabetes is a disturbance of the normal metabolism, in the sense that an excess of glucose is excreted into the urine; and this disturbance is caused by a defective functioning of the pancreas.
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> Frederick Banting and Charles Best, 1921: Diabetes is a disturbance of the normal metabolism, in the sense that an excess of glucose exists in the urine; and this disturbance is caused by reduced secretion of insulin from the islets of Langerhans of the pancreas.

> George F. Cahill, 1976: Diabetes is a constellation of anatomical and biochemical abnormalities which have in common a disturbance in glucose homeostasis, caused by a deficiency in the beta cells of the endocrine pancreas.[2]

It is tempting to regard this development as a process leading to a deeper understanding of the "true" nature of diabetes. Aretaeus during the second century BC and Banting & Best in the 1920s are talking about the "same" disease, one might claim—the difference being only that Aretaeus was less knowledgeable than Banting & Best and that therefore the latter had a greater chance of discovering the deeper properties of the disease.

There is probably some truth in such a description. The ancient symptom picture corresponds quite well with the modern clinical view of diabetes and we have reason to believe that Aretaeus and Banting & Best delineated roughly the same phenomena. Were this not so, it is hard to believe that the term 'diabetes' could have survived for over two thousand years. It would have been much more difficult to identify any of the fevers of the 18th century with today's influenza.

Despite this close correspondence between the ancient and the modern symptom picture of diabetes, we must be aware of the idea that we are talking about the same disease in the two cases. Our modern concept of diabetes is not only more complex than the old one, it is also more exclusive: it excludes a number of pathological phenomena that would have been included by Aretaeus, and identifies them as non-diabetes. If we are to speak of proper diabetes in the modern sense, its bearers must fulfil the clinical requirement that the beta-cells display certain specific defects. Many non-diabetic illness pictures fulfil Aretaeus' conditions. Excessive thirst and urination can occur among non-diabetics. There can be disturbances in the glucose balance of non-diabetics. There can even be lack of insulin in the case of people who are not diabetics in the modern sense—the production of insulin can be blocked by external factors and not by changes in the beta-cells.

Briefly put, the classical concept of diabetes was different from, and more inclusive than, the modern one. This leads to the crucial conclusion that any attempt to compare the ancient diabetes panorama with the modern one requires much careful thought. There are good reasons for drawing the same conclusion with regard to many other disease concepts from a historical perspective.

Thus, medical concepts are constantly changing. To systematize diseases must therefore be a very preliminary measure, awaiting new theory and new

[2] For a treatment of the development of the concept of diabetes where these authors are cited, see (Papaspyros 1964). For further analysis of this and similar developments, see (Nordenfelt 1995, 151–173).

discoveries. For the theorists of the 18th century this was not the case. They belonged to an Aristotelian tradition according to which all categories were eternal and unchanging. The task of the scientist was to discover these categories and give them names. Through medical revolutions this classical attitude became untenable. Within a couple of decades, all of the traditional nosological systems became unusable. Soon, indeed, the whole enterprise of the scientifically sound classification of diseases became obsolete. The great medical researchers and theoreticians of the 19th century—among them Xavier Bichat, Claude Bernard and Rudolph Virchow—never undertook this kind of enterprise.

3. Classification in the service of epidemiology

Some kind of classification of pathological entities is nevertheless necessary for several purposes. For statistical and epidemiological work, society requires that we are able to identify disease entities and find common ways of classifying them. Not least in the fight against the causes of death, one has to make some kind of categorization and thereby obtain an overview of these causes. However, among clinicians there is also a need for defining disease concepts in order to communicate between clinics and countries.

These needs led to the development of quite a different kind of disease classification during the 19th century. I will here just mention a few elements in the early history of this development. One of the first attempts to create a list of causes of death was that of the Swedish Statistical Bureau (*Tabellverket*) in 1749. It was a short list, containing only 33 species of causes of death, but it is worth mentioning that since that time an uninterrupted registration of causes of death has taken place in Sweden, which means that Sweden has the longest tradition in the world in this respect.[3]

More ambitious classifications for these practical purposes were undertaken in England. The physician William Farr (1807–1883), an employee of the General Register Office in London, was prominent in this development. He developed a system whose main categories were the following: 1. Infectious diseases; 2. Sporadic diseases; 3. Accidents or external violence. His very comprehensive classification was not universally accepted, though. In England there was still some hesitation regarding the need for a general classification of diseases.[4]

For various reasons, the centre of vital statistics soon moved from London to Paris. The leader of the French statistical bureau, Jacques Bertillon, initiated the programme of a worldwide classification of diseases and causes

[3] For a short description of the history the Swedish Statistical Bureau, see (Arosenius 1928).
[4] See (Farr 1885).

of death. In 1893, under Bertillon's leadership, the First International Classification of Causes of Death was launched.[5]

Bertillon's significance was that he attempted to create a fixed ground for his classification. His system had an anatomical-topological foundation. Thus, diseases should in principle be classified on the basis of their sites in the body. Bertillon was conscious of the fact that there could be reservations about such a system. There is something superficial in focusing on the anatomical site. The site does not reveal much about the facts in which the scientist or the doctor is mainly interested, namely the aetiology, pathology or prognosis of a disease.

Bertillon's point, however, is precisely that the primary purpose of the classification is *not* to mirror the latest scientific development. The purpose is instead to organize vital statistics and ameliorate international communication about diseases over time. If the classification were completely dependent on the state of the art of medicine, it would have to be changed very frequently. Bertillon's argument is laudable. However, for obvious reasons, he could not achieve the ultimate classification that he sought. The topological ground for division could not be the sole ground for his classification. When a disease has been located to a certain site, say the skin, then one has to make further distinctions in order to determine what species of disease it is. One has to distinguish between cancer of the skin, skin infections and allergic reactions on the skin, for instance. All of these diseases can attack the same point of the body. Thus, finer distinctions must involve other grounds for division, namely aetiological and morphological ones. But these distinctions are as vulnerable as the others. If there are new developments in medicine that question the causal or morphological hypotheses of the time, there is reason for reclassification.

In spite of Bertillon's general argument, neither he nor the international classification which followed his proposal adhered strictly to the topological ground for division. Out of the 14 main classes of diseases that he suggested, only seven are specifically topological. A significant class contains "*maladies générales*" which have an indefinite localization. Among these diseases are tumours, infections and poisonings. Bertillon also introduced two classes based on age: diseases of children and of the elderly. In addition, there was a class for external causes of death, suicide and accidents.

Politically, Bertillon's classification was a success. It was adopted generally and at a conference in Paris in 1900 it underwent its first revision. In this

[5] The first revision of the classification of diseases and causes of death was published in 1907. For a comprehensive characterization of the development of the classifications, see (Fagot-Largeault 1989). For an analysis of Bertillon's and other systems for the purpose of assessing causes of death, see (Nordenfelt 1983, 1986).

way, the fruitful system of regular recurrent revision which still functions today was launched. The most important revision conference (the sixth) was held in 1948 under the aegis of the recently established WHO. During this conference, worldwide cooperation with regard to medical statistics was established. All countries that had joined the United Nations entered into this cooperative programme. Also established was a much richer classification of *Diseases, Injuries and Causes of Death*. It is crucial to emphasize that the purpose of the classification was now broader than before. The classification was now also to be used for clinical ends and not just for the assessment of causes of death. The structure and the basic content of the classification were, however, still based on Bertillon's ideas. Instead of 14 classes there were now 17. The "*maladies générales*" were split into tumours, infections and endocrine diseases. A substantial category of mental disturbances was introduced. It is interesting that the class of diseases of the elderly vanished. The species of senility was moved into the category of symptoms.

In the present *International Statistical Classification of Diseases and Related Health Problems* (ICD 10) from 1992, the classes have increased to 22. Some of the rubrics do not, however, denote pathological conditions. Consider the classes XXI Factors influencing health status and contact with health services and XXII Codes for special purposes.[6]

Number	Rubric
I	Certain infectious and parasitic diseases
II	Neoplasms
III	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism
IV	Endocrine, nutritional and metabolic diseases
V	Mental and behavioural disorders
VI	Diseases of the nervous system
VII	Diseases of the eye and adnexa
VIII	Diseases of the ear and mastoid process
IX	Diseases of the circulatory system
X	Diseases of the respiratory system
XI	Diseases of the digestive system
XII	Diseases of the skin and subcutaneous tissue
XIII	Diseases of the musculoskeletal system and connective tissue
XIV	Diseases of the genitourinary system
XV	Pregnancy, childbirth and the puerperium

[6] Ceusters and Smith (2007) have made a critical analysis of the standard medical classifications and particularly discussed the ontology of the entities listed in these classifications.

XVI	Certain conditions originating in the perinatal period
XVII	Congenital malformations, deformations and chromosomal abnormalities
XVIII	Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified
XIX	Injury, poisoning and certain other consequences of external causes
XX	External causes of morbidity and mortality
XXI	Factors influencing health status and contact with health services
XXII	Codes for special purposes

4. The dream of an ideal classification of diseases

The problem of identifying and classifying pathological phenomena remains. These phenomena are, as I have already indicated, not like plants and animals. One cannot place a needle in them and thereby easily identify them. From an ontological point of view, they are not physical objects but instead types of processes with no clear beginnings and ends. It then becomes slightly arbitrary how we delineate them. How should we carve into the continuous processes and thereby define the disease entities?

The development of the science of medicine is more dramatic now than a hundred years ago and we are getting to know more about pathological processes and their aetiological backgrounds. The reasons for redefining and reclassifying diseases are now often greater than before. It seems, then, that one has to think in a radically new way in order to improve the systematic analysis of this area. One may have to radically distance oneself from ordinary diagnostic concepts.

The first groundbreaking work pointing in a new direction was performed by the College of American Pathologists and resulted in a taxonomy called the *Systematized Nomenclature of Pathology* (SNOP), published for the first time in 1965. The basic idea in this taxonomy is that a disease is an entity encompassing four dimensions:

1. Topography
2. Morphology
3. Aetiology
4. Function

A complete disease concept, according to this analysis, is thus one that contains qualifications in all dimensions. One example is *Staphylococcus*

pneumonia, associated with breathing difficulties. The disease is topographically localized in the tissues of the lung, morphologically characterized as an inflammation, aetiologically explained by reference to the staphylococci bacteria and functionally described in terms of breathing difficulties. In the same manner, all kinds of diseases are seen as describable within four dimensions.

In a way, the concepts of the *Systematized Nomenclature* can express much more than the traditional concepts. The mathematical possibilities of combining the elements in the matrix are extremely multifold. Many of these possibilities, however, are empirically uninteresting since, as far as we know, they cannot be realized. But others await their realization and hence also a name, and here SNOP is well prepared.

On the other hand, many currently accepted diseases are even more complex than the matrix manages to characterize. Since SNOP is a strictly pathological nomenclature, it does not include all clinical findings, in particular the subjective symptoms which are so characteristic of certain diseases. The pain and fatigue involved in most serious diseases are left outside the matrix. It is moreover crucial to note that ICD includes a special class for symptoms and other abnormal clinical findings. These cannot be classified at all within the SNOP system.

5. The modern SNOMED characterization

SNOP, however, has had ambitious successors, the most renowned of which is the so-called SNOMED, the *International Systematized Nomenclature of Human and Veterinary Medicine*, which is now being administered by the International Health Terminology Standards Development Organisation (IHTSDO). This taxonomy, which has been in the process of development for almost 30 years, is extremely comprehensive. In addition to diseases, it covers chemicals, drugs, enzymes, other body proteins, living organisms, physical agents, spatial relationships, etc. In 2010, it consisted of 291,000 concepts, 758,000 ordinary-language descriptions and 823,000 defining relationships.

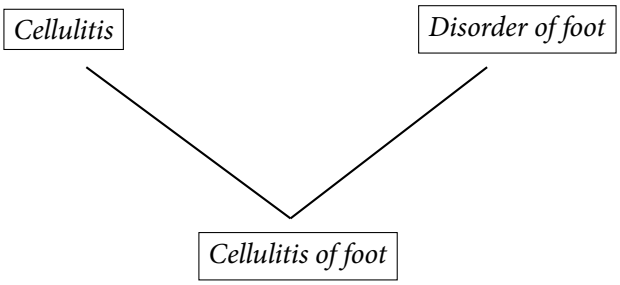
The relationships of SNOMED link concepts to each other and are of different types. The most crucial relationship is called *Is_a*. It relates subtypes to supertypes and is always a defining relationship. An example of an *Is_a* relation is simply: tuberculosis is an infection. All concepts except root-concepts have at least one *Is_a* relationship to a supertype concept. This makes SNOMED a poly-hierarchical system. Most diseases are subtypes of the root-concept *Clinical finding* but they belong to many hierarchies on lower levels in the system, to be exemplified below.

Other relationships which are defining relationships are the so-called

defining attribute relationships. Examples of such relationships are *Finding site*, *Associated morphology*, *Causative agent*, *Severity*, *Clinical course*, *Pathological process*, *Occurrence*, *Finding method* and *Finding informer*. An example of the *Finding site* relationship is simply: pneumonia is situated in the lungs.

A concept in SNOMED is either fully defined or primitive. A fully defined concept is modelled as described above, and thereby specified in terms of all defining relations. It can thereby be completely distinguished from other, similar concepts. A primitive concept lacks one or more of the defining relationships. This means that most concepts contained in the present ICD must be called primitive concepts.

The basic analysis in SNOMED is indeed Aristotelian. The classification defines concepts in the classical way of *per genus proximum et differentiam specificam*. *Per genus proximum* is the subtype-supertype relation. *Differentia specifica* is constituted by the defining attributes. But there is a major difference from the Aristotelian ideal in that SNOMED's types and species can belong to more than one hierarchy. There are for every disease, therefore, several *genera proxima*. Consider:

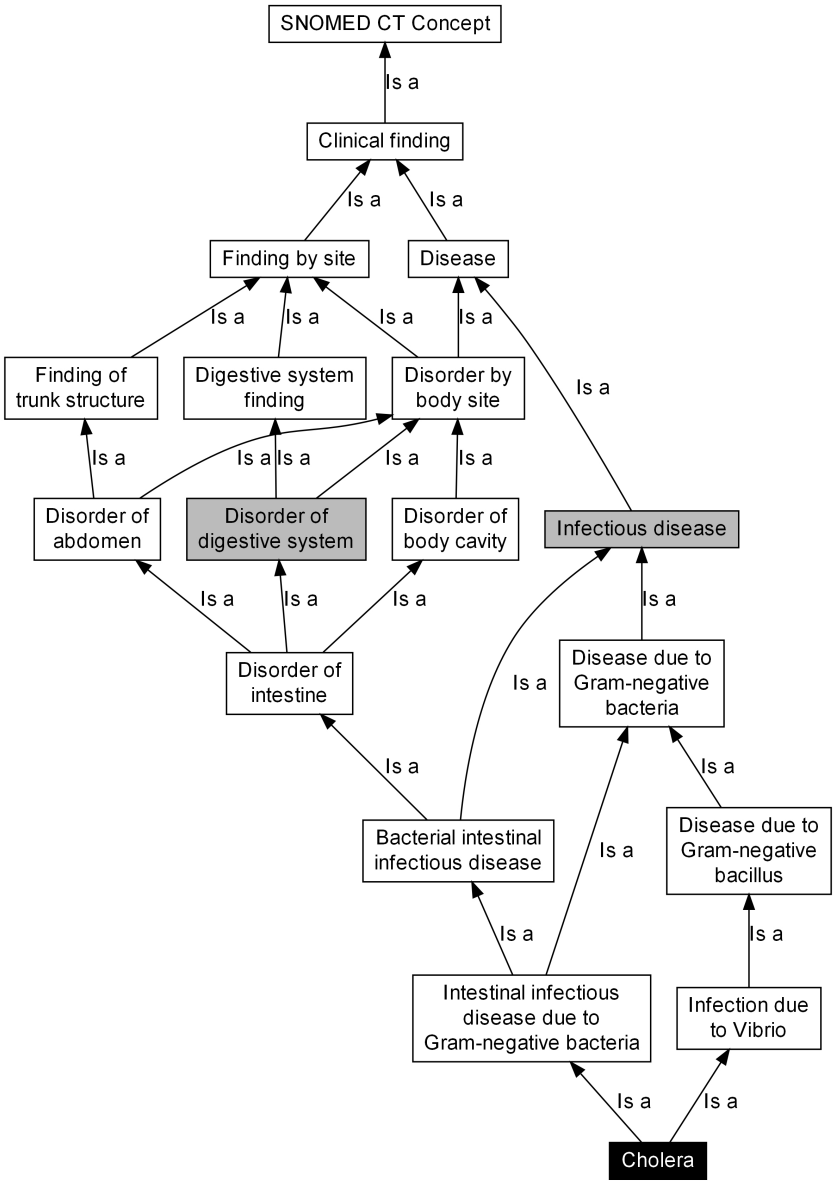


The clinical finding *Cellulitis of foot* thus belongs to at least the two genera: *Cellulitis* and *Disorder of foot*.

For every disease there is a complete identifying linguistic description. One example is: *Myocardial infarction disorder*. This complete description need not be the preferred expression in medical practice. In this case, it is the shorter *Myocardial infarction* which appears in ICD.

SNOMED expands the thinking of SNOP. It does not stop at four dimensions but adds a great number of further dimensions that may be required for the complete individuation of a disease. This means that the mathematical possibilities of creating new concepts are immensely greater.

In order to see how one might individuate a particular disease according to SNOMED, consider the following tree of classification:



6. Some questions and problems regarding SNOMED

SNOMED constitutes an interesting advance in relation to SNOP. It is much more comprehensive as it covers much more ground. It includes, in addition to the classification of diseases and illnesses, nomenclatures for, for instance, chemicals, drugs, diagnostic methods and therapies. It should furthermore be noted that SNOMED is meant to be read and handled by computers. This

certainly places additional restrictions on the system.

A general consequence of the complexity of SNOMED is that there are not, as there are in ICD, limited sets of classes of diseases. There are not just 22 classes: there are at least as many classes as there are *Is_a* relationships. It is also possible to construct classes based on all the other relationships. Thus, in order to find a particular disease in the network, one cannot normally begin by just asking which class it belongs to—it may belong to several classes, orders and genera. This is a radical step away from the classic Aristotelian idea of a natural classification of things. A species, according to the latter way of thinking, belongs to one genus and nothing more.

Is the multiplicity of possible classifications according to SNOMED a problem for the theory of the identification and classification of diseases? A first reaction is that it need not be. It may be an advantage that there are no privileged classifications. It is crucial to know that *diabetes mellitus*, for example, can be traced along various axes. This will automatically tell us much more than if we are merely informed that diabetes is an endocrine disease. On the other hand, it would seem that for some (for instance, administrative) purposes it is reasonable to prefer a classification such as ICD. Although some diseases can occur in different places in ICD too, most of them have just one position in the system and occur under one supertitle. The common cold, according to ICD, is an infection and leukaemia is a neoplasm and nothing else. It seems indeed as if the SNOMED constructors themselves are conscious of a limitation of their system in this respect. There are now attempts to join forces. Several expert groups are trying to match the SNOMED nomenclature to that of ICD.

But are there more than administrative reasons for such endeavours? Are there any deep medical reasons for classifying diseases according to the classic tradition? I personally doubt this, given the inevitable historical changes I described above. However, I think that this is an interesting philosophical question which requires further thought. Let us first look at the historical development of the characterization of diseases I briefly discussed above. This development can be quickly and superficially described as a process leading from the surface of the individual to deeper layers of the individual, from symptoms to physiological functions, to cells, to microbes and finally to genes.

As soon as we discover the (probable) causes of a symptom, say a fever, in terms of a physiological dysfunction, the tendency is to say that the disease *is* basically a physiological dysfunction. And as soon as a particular dysfunction is explained in terms of morphological, in particular cell, changes, the site of the disease is moved to that place. The disease is, as Virchow would put it, a change in the cell.

When the change in the cell is, in turn, explained as caused by a microbial invasion, then the disease, as in the case of tuberculosis, is identified through its microbial cause. And finally, the genetic revolution within medicine means that some diseases are now characterized in terms of certain defects in the DNA structure.

In general, there is a tendency to say that there is some privileged site of a disease and that this site harbours the causal root of the disorder. The "real" disease is the ultimate cause of the problem. Thus, this ultimate state or process should, according to this reasoning, constitute the ground also for the classification of the disease.

There is a certain understandable logic in this analysis. Unfortunately, however, it is impossible to follow this logic consistently. The obvious reason is that with many diseases there is no such ultimate site to be found. We do not, in general, know of any DNA defects behind psychosomatic or mental diseases. Often, we do not in such cases know of any physical disturbances at all. We may also have reason to believe that there are no salient physical disorders lying behind such diseases.

But we should not just stick to cases which are so obviously problematic for the idea of a privileged ground for medical classification. There are often good reasons for identifying diseases and disorders in general from a clinical perspective or indeed from the patient's perspective. It may sometimes be uninteresting from a clinical point of view to trace the ultimate causes of a disease (or rather an illness, when we adopt the patient's point of view). What is important for the patient is care and a prognosis. Therefore, there might be a demand for a classification in terms of these in the clinic.

It may of course be conceded that care and prognoses are often dependent on what is the "ultimate" disease in the causal sense. But they need not be. With certain chronic illnesses, such as chronic pain, there may be no known cause or the connection between the pain and the ultimate cause may be so remote that the latter does not play any role in the care of the patient.

My conclusion is therefore that the search for an ultimately privileged classification of diseases is probably in vain. For pragmatic purposes, we certainly need a universally recognized and unified classification such as ICD, but we should probably—for reasons discussed above—accept and come to terms with its manifold logical deficiencies.

7. Concluding remarks

We have travelled a very long way from Aretaeus the Cappadocian and from the medical theorists of the 17th century to the medical systems of today. The history of medical classification mirrors in an interesting way the gen-

eral development of medicine. In earlier days, diseases were identified with symptoms; with the advent of pathology and cell biology, diseases were to be found inside the body; with the advent of bacteriology, they were seen as having concrete external causes; and with the advent of molecular biology and genetics, the genesis of certain diseases became much more transparent. All of this is very difficult to capture within a classification of diseases. One can always question where the borders of diseases lie.

However, simply abstaining from identifying and classifying diseases is not an option. For the purposes of epidemiology, and for medical communication in general, we must have some instrument for individuation and classification. SNOMED is an ambitious attempt to fulfil most of the desiderata. It accommodates the complexity of diseases and it paves the way for many conceptual novelties. But for the foreseeable future, the SNOMED system must be complemented with a pragmatic classification such as ICD.

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